Early Journal Content on JSTOR, Free to Anyone in the World

This article is one of nearly 500,000 scholarly works digitized and made freely available to everyone in the world by JSTOR.

Known as the Early Journal Content, this set of works include research articles, news, letters, and other writings published in more than 200 of the oldest leading academic journals. The works date from the mid-seventeenth to the early twentieth centuries.

We encourage people to read and share the Early Journal Content openly and to tell others that this resource exists. People may post this content online or redistribute in any way for non-commercial purposes.

Read more about Early Journal Content at http://about.jstor.org/participate-jstor/individuals/early-journal-content.

JSTOR is a digital library of academic journals, books, and primary source objects. JSTOR helps people discover, use, and build upon a wide range of content through a powerful research and teaching platform, and preserves this content for future generations. JSTOR is part of ITHAKA, a not-for-profit organization that also includes Ithaka S+R and Portico. For more information about JSTOR, please contact support@jstor.org.

Summary.

Replies received	497
Amount expended in squirrel destruction on 321,233 acres	$36, 091. 85
Amount expended per person	$72. 61
Amount saved as a direct result of squirrel destruction	$109, 301. 50
Amount saved per person	$201. 81

CYANIDE FUMIGATION OF SHIPS.

METHOD USED AT NEW ORLEANS.

By NORMAN ROBERTS, Passed Assistant Surgeon, United States Public Health Service.

Hydrocyanic acid is potentially about the most dangerous to human life of any of the better-known fumigating agents. Hence the United States Public Health Service has hitherto generally avoided its use; but recently circumstances at New Orleans have combined to make the employment of any other agent impracticable for certain vessels, and a procedure was evolved which at the present writing appears to be effective against rodents and insects, rapid, harmless to ship and cargo, not unduly expensive (considering the total of first cost, labor, and supplies), and when properly used, reasonably safe[1]—a combination of good qualities possessed to the same degree by no other fumigant.

In the fumigation of ships at New Orleans two methods are used, in both of which potassium or sodium cyanide is decomposed by sulphuric acid, as expressed by the chemical equation—

$$KCN+H_2SO_4=HCN+KHSO_4.$$

By either method 1 ounce of KCN is used for each 100 cubic feet with 1⅔ ounces (about 1 fluid ounce) of sulphuric acid, and 3 fluid ounces of water. (Proportionately more when required).

The first method (the "crock" or "solid cyanide") is similar to that used by citrus growers, and is used in small accessible compartments, such as living quarters and store rooms. The sulphuric acid is diluted with the whole of the water, either two or three parts by volume (see later) and put into the container (preferably while still hot after the admixture); and the solid cyanide, the proper amount of which for each compartment has been previously weighed out into a bag, is dropped into the dilute acid. The compartment has been prepared previously by closing and where necessary calking or papering all openings except one; through this the operator enters or reaches to drop in the cyanide, after which he quickly escapes and this last opening is tightly closed.

---

[1] It is not reasonable to expect of any agent efficient in the destruction of rats—one of the hardiest and wariest of man's animal enemies—that it shall be incapable of taking human life. The proper safeguards against danger from a fumigating gas are system, skill, and vigilance on the part of the fumigators and the ship's officers.

This (solid cyanide) method is safe and certain for small and easily accessible inclosures, and on account of its simplicity, etc., is the best for such compartments on shipboard, but it is not trustworthy for unit quantities of cyanide larger than about 3 pounds (sufficient for about 5,000 cubic feet of space). Hence the solid-cyanide method is not safe to use in holds, where the operator must stay a considerable time putting cyanide into a large number of crocks and then escape through the top of the compartment, where the gas soon tends to concentrate.

The second method (the "barrel" or "liquid cyanide") is used in the holds, and is carried out by diluting the acid with part of the water in the barrel, which is then swung down to the lowest accessible point in the hold; the cyanide, previously dissolved in the remainder of the water, is then poured into the barrel from the deck by means of a pitcher and funnel through a long rubber hose. After the cyanide is all in, it is followed after a few seconds or minutes by a strong sodium carbonate solution, which expels part of the dissolved hydrocyanic acid from the waste and reduces the remaining acidity, thus economizing on the expensive cyanide and rendering the waste less poisonous, corrosive, and troublesome.

Apparatus, Materials, and Preparation.

Crocks.—These are of the 1-gallon size and of cheap glazed stoneware, best plain cylindrical in form, and with the height about equal to the diameter. One gallon of crock capacity is sufficient for 10 ounces of cyanide with acid and water, which is usually the quantity used to fumigate 1,000 cubic feet.

Buckets.—Ordinary cheap fiber buckets, of about 3 gallons capacity, are used to carry the crocks around in and to prevent damage if they break.

Bags.—Best made of thin, close muslin, but paper will do. The proper function of the bag is to facilitate the distribution of the cyanide and thereby save valuable time during the fumigation, not (as sometimes recommended) to delay the reaction between the chemicals. If paper is used, it should be torn as the bag is dropped into the acid; otherwise it may remain unpenetrated.

Barrels.—Any strong, water-tight wood barrel will do; 50-gallon oil barrels have been used at New Orleans. It would probably be advantageous to char the inside of the barrel and line it with a small quantity of paraffin, driven as deeply as possible into the wood by heat; but untreated barrels, originally in good condition, appear to last for several fumigations without marked deterioration if not subjected to the action of unduly strong acid, as by mixing the acid and water in the barrels without sufficient stirring. A 50-gallon barrel will serve for the decomposition of about 80 pounds of cyanide (125,000 cubic feet of space), but it is better to use much smaller charges (20 to 30 pounds—30,000 to 45,000 cubic feet of space) and more barrels, on account both of the difficulty of handling barrels full of a troublesome liquid and of the faulty distribution of the gas when given off from a single source into a large hold complicated by cargo barricades and decks.

Piping.—Light garden hose or single-ply rubber tubing of about the same diameter is provided in pieces long enough to reach from 2 or 3 feet above the hatch combing to about a foot below the top of the barrel. At this point it is slipped and tied securely over an L-shaped piece of lead pipe which extends vertically to the bottom of the barrel and horizontally halfway across, opening either at the end or by several small holes along the side.

Cyanide.—What is properly known as 98–99 per cent potassium cyanide is the standard and meets all of the usual requirements. High-grade sodium cyanide (the so-called 130 per cent) is a substitute at least equal in all respects and better in some. As, in equal weights, potassium cyanide contains about one-fourth less cyanogen than sodium cyanide, one-fourth less sodium cyanide should be used if substituted for potassium cyanide. The salt comes in lumps, which may be used whole or slightly broken in the crocks, but should be well powdered (best in a mill) immediately before making up into solution for the barrel, because otherwise solution is slow and difficult.[1]

Cyanide solution (for use in the barrel).—Not much more than enough water should be used to dissolve the cyanide completely. Potassium cyanide dissolves in about 2 parts of water at ordinary temperatures; of sodium cyanide, about 82 parts dissolve in 100 of water. The solutions are sufficiently stable to keep a few hours if necessary; but for several reasons should not be kept long, unnecessarily.

Sulphuric acid.—Ordinarily, the commercial oil of vitriol, of about "66° B" strength, coming in carboys, contains no deleterious amount of impurities. In diluting it, the water is *first* poured into the vessel and the acid is poured into the water in a fine stream, the water being kept constantly circulating to prevent accumulation of strong acid under the water, which may char the barrel (if of wood or fiber), or violently boil and scatter the acid. The acid should, if possible, be diluted just before using, in order that the heat evolved may not be lost, but be utilized as much as possible in expelling the hydrocyanic acid from the liquid.

---

[1] The most injurious impurity found in the cyanide is chloride, usually common salt. This destroys more or less (up to over 90 per cent) of the hydrocyanic acid as fast as formed by hydrolyzing it into the inert and corrosive formic acid. Unfortunately this impurity is sometimes hard to avoid, inasmuch as there are at present on the market large quantities of so-called "potassium cyanide," "cyanide-carbonate-chloride mixture," etc., most of which consist essentially of sodium cyanide with the cyanogen content reduced to the equivalent of about 99 per cent potassium cyanide by the addition of supposedly inert compounds, unfortunately in many instances sodium chloride.

Water.—Salt water will, of course, not do; neither will certain (untreated) river waters, such as that of the Mississippi at New Orleans, which latter sometimes produces a slimy precipitate with the cyanide, choking the tubing. But most ordinarily pure waters are suitable; in any given case a little simple experimentation will show.

Proportions.—The best proportions for potassium cyanide are considered to be about 1:1:3, and for sodium cyanide 1:1½:2. This means, for instance, 1 *pound* (or kilogram) of potassium cyanide to each 1 *pint* (or liter) of concentrated sulphuric acid, with 3 *pints* (or liters) of water.[1]

These proportions can be adhered to in the crock method, but in the barrel method more water may be necessary to dissolve the cyanide *and* dilute the acid separately.

Sodium carbonate solution.—A nearly or quite saturated solution of common washing-soda crystals. About half the weight of the cyanide may be used. To neutralize the residual acid completely, about one and one-half times the weight of the original concentrated acid is needed.

Advantages of Cyanide Fumigation.

Hydrocyanic acid vapor when mixed with air in the proportion of about 0.4 per cent rapidly kills rodents, insects, and many (microscopic) plants, including some bacteria. It is said to be particularly efficacious against fleas; bedbugs and croton bugs require larger quantities. For use against plague it has the great advantage that it penetrates most articles of cargo without damaging them, killing the vermin, no matter how deeply hidden. In rapidity of action on rats it is in the same class with carbon monoxide and far superior to any other commonly used raticide, probably because both are absorbed rapidly and in large quantities by the hemoglobin and carried to the nerve centers, whereas the other commonly used gaseous narcotic poisons are absorbed relatively slowly and in small quantities by the blood plasma.

---

[1] These proportions have been determined by calculation and experiment as those which most thoroughly expel the acid from the mixture, while at the same time guarding against the premature solidification of the waste by crystallization of the acid sulphate, which stops the reaction if it takes place before the cyanide is completely decomposed.

Hydrocyanic acid is slightly lighter than air; hence in its use care must be taken to prevent its escape from or undue concentration in the upper part of the space, leaving in the lower part too low a concentration to kill.

Remedies for this condition are: To allow time for the diffusion; to obstruct and scatter the rising column of gas by placing the generator under a low projection, or loosely covering with paper; to blow from an electric fan into or across the mouth of the generator; to mix a quantity of sodium carbonate (low in chlorides) with the cyanide, thus increasing the density of the gas.

As compared with sulphur dioxid, hydrocyanic acid has the advantages that, first, its use requires no fire; second, the gas penetrates rapidly and without damaging any ordinary article of cargo.

As compared with carbon monoxide, hydrocyanic acid kills fleas and other insects and requires for its production much less apparatus and no fire.

PLAGUE-ERADICATIVE WORK.

LOUISIANA—NEW ORLEANS.

The following report of plague-eradicative work in New Orleans for the week ended November 28, 1914, has been received from Surg. Corput, of the United States Public Health Service, in temporary charge of the work:

OUTGOING QUARANTINE.

Vessels fumigated with sulphur	24
Vessels fumigated with carbon monoxide	10
Vessels fumigated with hydrocyanic gas	2
Pounds of sulphur used	6,406
Coke consumed in carbon-monoxide fumigation (pounds)	16,900
Pounds of potassium cyanide used in hydrocyanic-gas fumigation	170
Pounds of sodium carbonate used in hydrocyanic-gas fumigation	170
Pounds of sulphuric acid used in hydrocyanic-gas fumigation	280
Clean bills of health issued	24
Foul bills of health issued	10

OVERLAND FREIGHT INSPECTION.

Cars inspected, found in good order, permitted to load	986
Cars ordered repaired before loading	1,381
Cars condemned	3
Total cars inspected	2,370

DESTINATION AND NUMBER OF RAILROAD CARS INSPECTED WEEK ENDED NOV. 28.

Alabama	88
Arkansas	5
California	7
Carolina, North	1
Carolina, South	4
Colorado	15
Florida	31
Georgia	22
Illinois	170
Indiana	17
Iowa	6
Kansas	1
Kentucky	21
Louisiana	834
Massachusetts	4
Michigan	11
Minnesota	4
Mississippi	310
Missouri	59
Montana	1
New Mexico	1
New York	15
Ohio	42
Oklahoma	2
Pennsylvania	19
Tennessee	126
Texas	172
Virginia	4
Wisconsin	11
Canada	9